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EXAMINER	
HSU, AMY R	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/752,462	MURESAN, DARIAN	
	Examiner	Art Unit	
	Amy Hsu	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☒ Claim(s) *2* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :5/18/2007, 4/13/2007, 2/10/2004.

Claim Objections

1. Claim 2 is objected to because of the following informalities: Claim 2 reads, " ...estimating the missing red pixels in ***blue*** pixel locations...". However, the specification does not support the claim as worded. The specification in paragraph 37 reads, "...missing red pixels in ***green*** pixel locations...". For purposes of examination, the meaning supported by the specification, missing red pixels in ***green*** pixel locations, will be used in place of Claim 2. Appropriate correction is required.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

> **Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.**

Claims 8-13 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Computer-readable media are descriptive material per se and are not statutory because they are not capable of causing functional change in the computer. In contrast, computer readable medium encoded with instructions capable of being executed by a computer defines structural and functional interrelationships between the computer software and hardware components which permit the functionality to be realized, and is thus statutory.

For art examination purpose, these claims will be interpreted, as they are best understood.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> **A person shall be entitled to a patent unless –**
>
> **(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.**

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

4. Claims 1-5, 8-12, and 14-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Kakarala et al. (US 7088392).

Regarding Claim 1, Kakarala teaches a computer-implemented method for determining from an input color filter array (CFA) sampled image, an edge direction (*Col 3 Lines 39-41 Kakarala teaches an adaptive demosaicing algorithm to determine the direction of interpolation from a digital image from a CFA, Col 4 Lines 60-61)*, the

method comprising: calculating for a current missing green pixel, interpolation errors in an East-West (EW) direction at known neighboring green pixels, and averaging the EW interpolation errors to obtain an EW error; calculating for the current missing green pixel, interpolation errors in a North-South (NS) direction at known neighboring green pixels, and averaging the NS interpolation errors to obtain a NS error; and selecting a direction indicated by a minimum of the EW error and the NS error as the edge direction. Kakarala teaches an interpolation method where the missing luminance values, or missing green pixels, are determined (*Col 6 Lines 2-5)* by using adaptive demosaicing using the an algorithm to interpolate from neighbor pixels *(Col 9 Lines 46-51).* Kakarala teaches a method where the optimal direction is that of the least change. Therefore in Kakarala's method, the values interpolated by using neighboring pixels are more in error when there is more change and less in error with less change because the method's purpose is to find the direction of least change to be used as the interpolation direction (*Col 9 Lines 49-51).* The interpolation is done in both the horizontal and vertical directions (*Col 12 Lines 29-34).* The direction of interpolation is determined by the interpolated values from the one of the horizontal and vertical directions with the least change or less error (*Col 9 Lines 50-51).*

Regarding Claim 2, Kakarala teaches the method of claim 1 wherein the selected edge direction, the sampled image, which includes a green channel (G) of green pixels, a red channel (R) of red pixels, and a blue channel (B) of blue pixels, are used to interpolate missing green pixels at red and blue locations in the green channel (*Col 6*

Lines 3-7 and Fig. 2) by: for the missing green pixel, interpolating a difference image comprising the G-B if the missing green pixel is in a blue location, or G-R if the missing green pixel is in a red location (*Col 6 Lines 50-65)*, in the selected edge direction (*Col 6 Lines 6-9 teaches that the interpolation is either horizontal or vertical based on a selected direction which is chosen based on the minimum change, which can also be known as the minimum error described in Col 9 Lines 47-49)*); in the blue channel, estimating missing blue pixels in green pixel locations using linear interpolation of the blue pixels in the blue channel in the selected edge direction; and in the red channel, estimating the missing red pixels in blue pixel locations using linear interpolation of the red pixels in the red channel in the selected direction (*Col 7 Lines 1-4)*, thereby providing an interpolated full green channel in which all missing green pixels have an interpolated value (*Fig. 2 reference number 35b)*.

Regarding Claim 3, Kakarala teaches the method of claim 2 wherein the sampled image and the full green channel are used to correct the green channel by: calculating the EW and NS interpolation errors for each pixel in the full green channel; averaging neighboring EW and NS errors at each green pixel (*Col 9 Lines 51-53 teach that the result, which can denote error, of interpolating in a vertical and horizontal directions is calculated)*; selecting the green local edge direction EW or NS based on the EW and NS average errors having a smallest value (*Col 9 Lines 47-49 teaches that the direction, either vertical or horizontal, that is chosen is based on that with the least change, which the result of interpolating that is calculated will indicate)*; estimating the

green pixels at blue pixel locations using linear interpolation of G-B in the selected direction, and wherein the missing blue pixels are interpolated in the selected direction; and estimating the green pixels at red pixel locations using linear interpolation of G-R in the selected direction, and wherein the missing red pixels are interpolated in the selected direction. Col 8 Line 60 shows an example of the green pixel at a red pixel location uses the above-described method for interpolation, similarly for blue. The selected direction is described in the paragraph addressing Claim 2.

Regarding Claim 4, Kakarala teaches the method of claim 2 wherein the sampled image and the full green channel are used to interpolate the red and blue pixels (*Col 6 Lines 15-16)* to obtain a quincunx sampling by: using the full green channel to estimate a local EW or NS edge direction by calculating errors in interpolation in EW and NS directions at each pixel; labeling each pixel's direction as one of EW or NS based on a minimum of the EW and NS average errors in a neighborhood of the current green pixel (*Col 6 Lines 6-9 describes a direction being selected based on in Col 9 Lines 47-49, a minimum change, which can be denoted by a minimum error)* ; at missing red quincunx samples, interpolating R-G in the direction of the label; and at missing blue quincunx samples, interpolating B-G in the direction of the label. Col 8 Line 60 shows a quincunx with a red pixel that uses the surrounding green pixels, this is similar for blue.

Regarding Claim 5, Kakarala teaches the method of claim 2 wherein the quincunx sampled red and blue channels and the full green channel are used to interpolate the red and blue pixels to obtain full red and blue channels (*Fig.2 shows the sampled red and blue channels, reference number 28a and b, along with the full green channel, 35b, is used to interpolate the red and blue pixels to obtain full red and blue channels, 35a and c)* by: using the full green channel to estimate a NE or NW edge direction by calculating errors in interpolation in NE and NW directions at each pixel; labeling each pixel's direction as one of NE or NW based on a minimum of NE and NW average errors in a neighborhood of the current green pixel; at the missing quincunx samples interpolating R-G in the direction of the local label; and at the missing quincunx samples interpolating B-G in the direction of the local label, as addressed with Claims 3 and 4.

Claim 8 claims computer-readable medium of the method of Claim 1 and is therefore similarly rejected.

Claim 9 claims computer-readable medium of the method of Claim 2 and is therefore similarly rejected.

Claim 10 claims computer-readable medium of the method of Claim 3 and is therefore similarly rejected.

Claim 11 claims computer-readable medium of the method of Claim 4 and is therefore similarly rejected.

Claim 12 claims computer-readable medium of the method of Claim 5 and is therefore similarly rejected.

Claim 14 is an apparatus claim of the method of claim 1 and is similarly rejected.

Claim 15 is an apparatus claim of the method of claim 2 and is similarly rejected.

Claim 16 is an apparatus claim of the method of claim 3 and is similarly rejected.

Claim 17 is an apparatus claim of the method of claim 4 and is similarly rejected.

Claim 18 is an apparatus claim of the method of claim 5 and is similarly rejected.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> **(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.**

6. Claims 6-7, 13, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kakarala et al. (US 7088392) in view of Suga et al. (US 5832143).

Regarding Claim 6, Kakarala teaches the method of claim 2 wherein corrected high density red, green, and blue channels are obtained from the input the full red, green, and blue channels (*Fig. 2)* by: using the G-R channel (*Fig.2 reference numbers 25b and 25a are the G and R channels or planes that comprise the G-R channel)* to estimate an edge direction and interpolating G-R in the direction of the selected label;

adding the red channel to the interpolated G-R to obtain a G_R channel (*Fig. 2 the input of 25a and 25b into 35b, G_{new}*); this is repeated for the blue plane (Fig. 2 reference number 25c), averaging the G_R and G_B channels in order to obtain a new green channel (G_{new}); calculating R-G_{new} channel (*Fig. 2 reference number 28a)*; using R-G_{new} to estimate various edge directions and interpolating R-G_{new} in the direction of the selected label and adding the new green channel to the interpolated R-G_{new} to obtain a new red channel (*Fig. 2 reference number 35a).* The argument is similarly applied to the blue channel as it is to the red. Kakarala also teaches the method of interpolation by using different directional interpolations such as horizontal and vertical interpolation (Col 6 Liens 6-8) and selecting the optimal interpolation direction by choosing the direction with the least change (*Col 9 Lines 49-51),* which can be found by denoting the direction with the least change as that with the least error. Kakarala fails to teach this interpolation method, called adoptive interpolation logic, at every point of interpolation such as from using R-G_{new}, Fig.2 reference number 28a to interpolate the new red channel, reference number 35a, where Kakarala uses different interpolation logic instead. However, it would have been obvious at the time of the invention to one of ordinary skill in the art to use adoptive interpolation logic at all points of interpolation because pooling of edge related information from all three color planes and interpolating based on optimal edge detection provides better sharper results.

Kakarala teaches the edge direction being a vertical and horizontal direction and fails to teach the NE and NW direction. Suga teaches a similar image data interpolation method where an optimal interpolating direction is selected based on

correlations between pixels. Suga teaches that in order to improve interpolation, it is necessary to evaluate pixels around the target pixels in more directions (*Col 3 Lines 4-7).*

It would have been obvious to one or ordinary skill in the art at the time of the invention to combine the teachings of Kakarala with the teachings of Suga to apply the NE and NW and other various directions other than horizontal and vertical in pixel interpolation because some images may have edges with gentle gradients or other conditions and cases where it becomes difficult for just horizontal and vertical interpolation to deal with all the cases so considering more directions gives more options and more optimal interpolation.

Claim 7 is a computer-implemented version of the method of Claim 6 and is therefore similarly rejected.

Claim 13 is a computer medium containing the method of Claim 6 and is therefore similarly rejected.

Claim 19 is an apparatus claim of the method of Claim 6 and is similarly rejected.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure including Hamilton, Jr. et al (US 5629734), Kawamura et al. (US 6563537), Easterly et al. (US 5038216), Kovacevic et al. (US 5661525), Yamashita et al. (US 5347599), Ma et al. (US 6965705), and Kim et al. (US 7035481).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Amy Hsu whose telephone number is 571-270-3012. The examiner can normally be reached on M-F 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lin Ye can be reached on 571-272-7372. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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